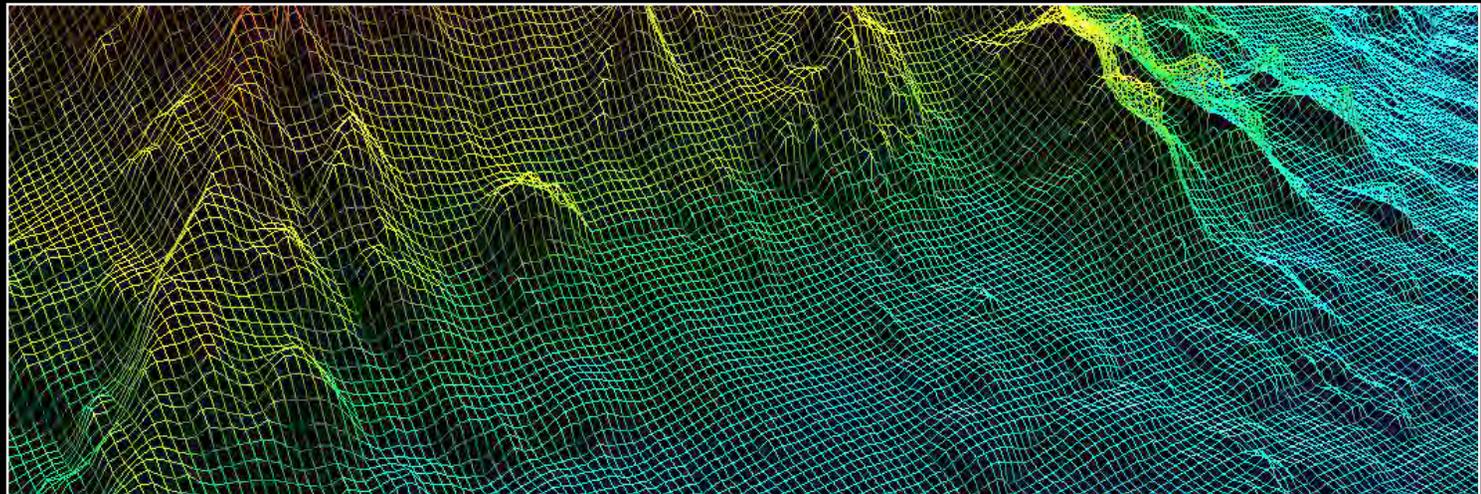


Regional and Nearshore Bathymetry of American Samoa: Implications for Tsunami Run-Up and Public Awareness



Presentation U21D-07
2009 AGU Fall Meeting
San Francisco



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American Samoa Government, Coastal Mgmt Program

Tectonic Setting

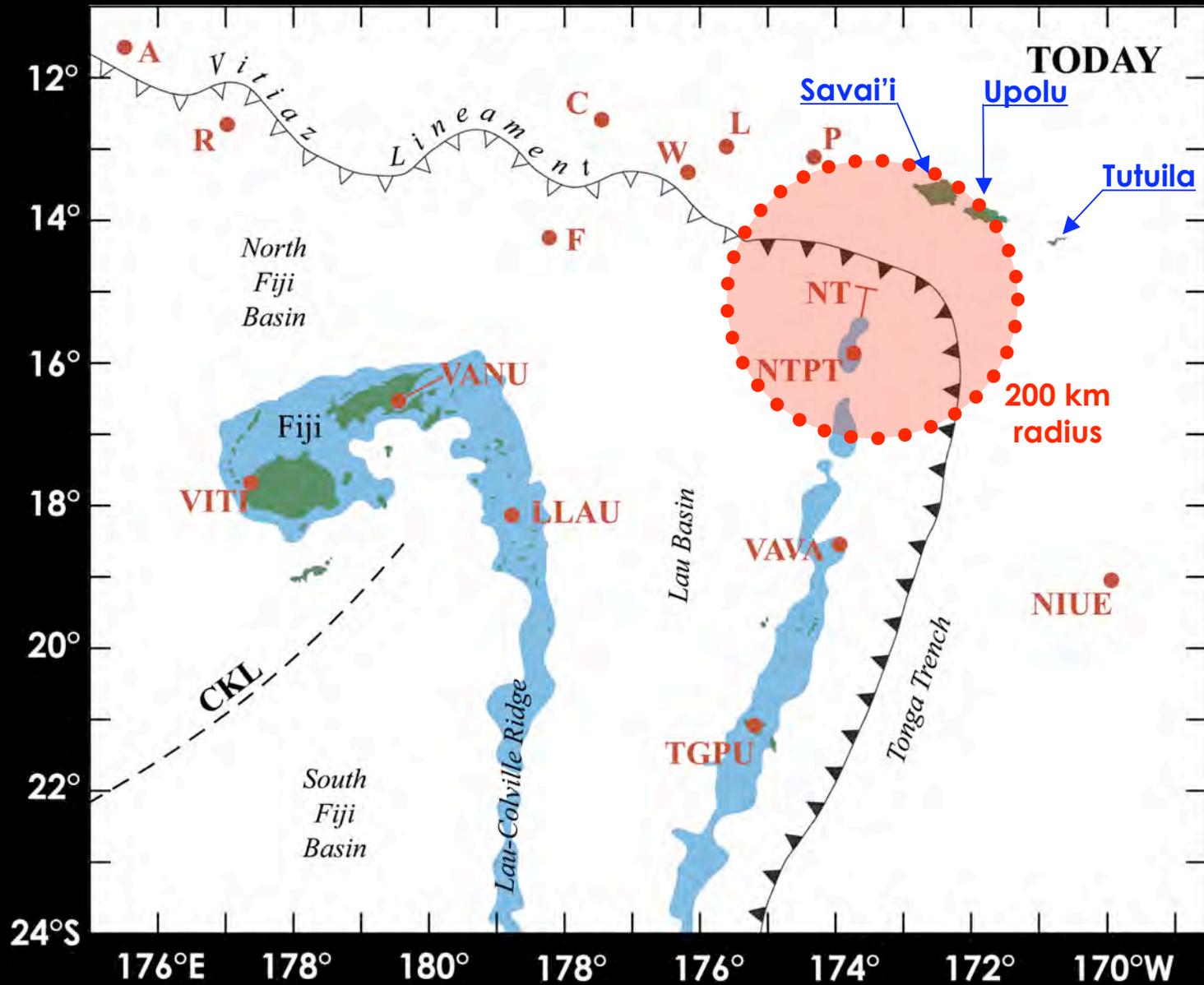
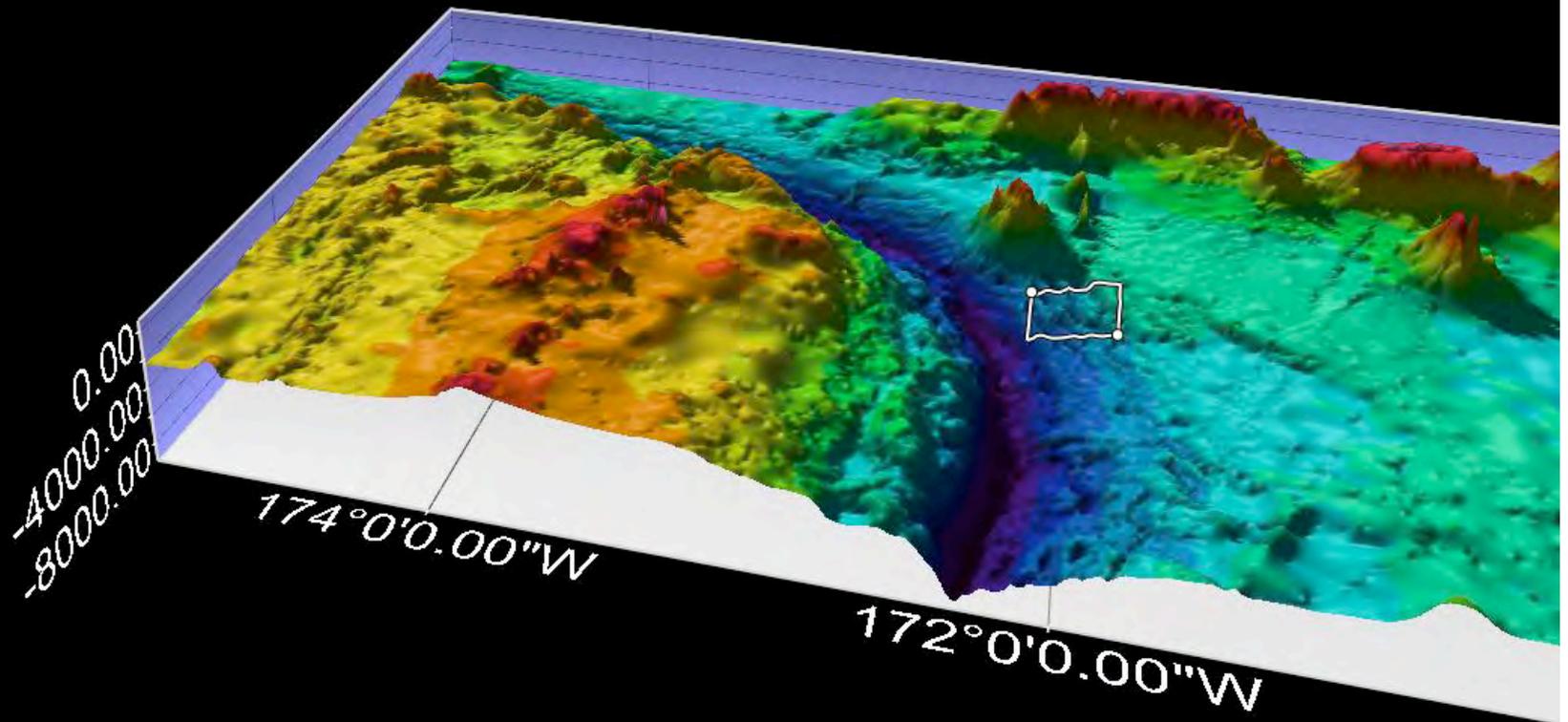
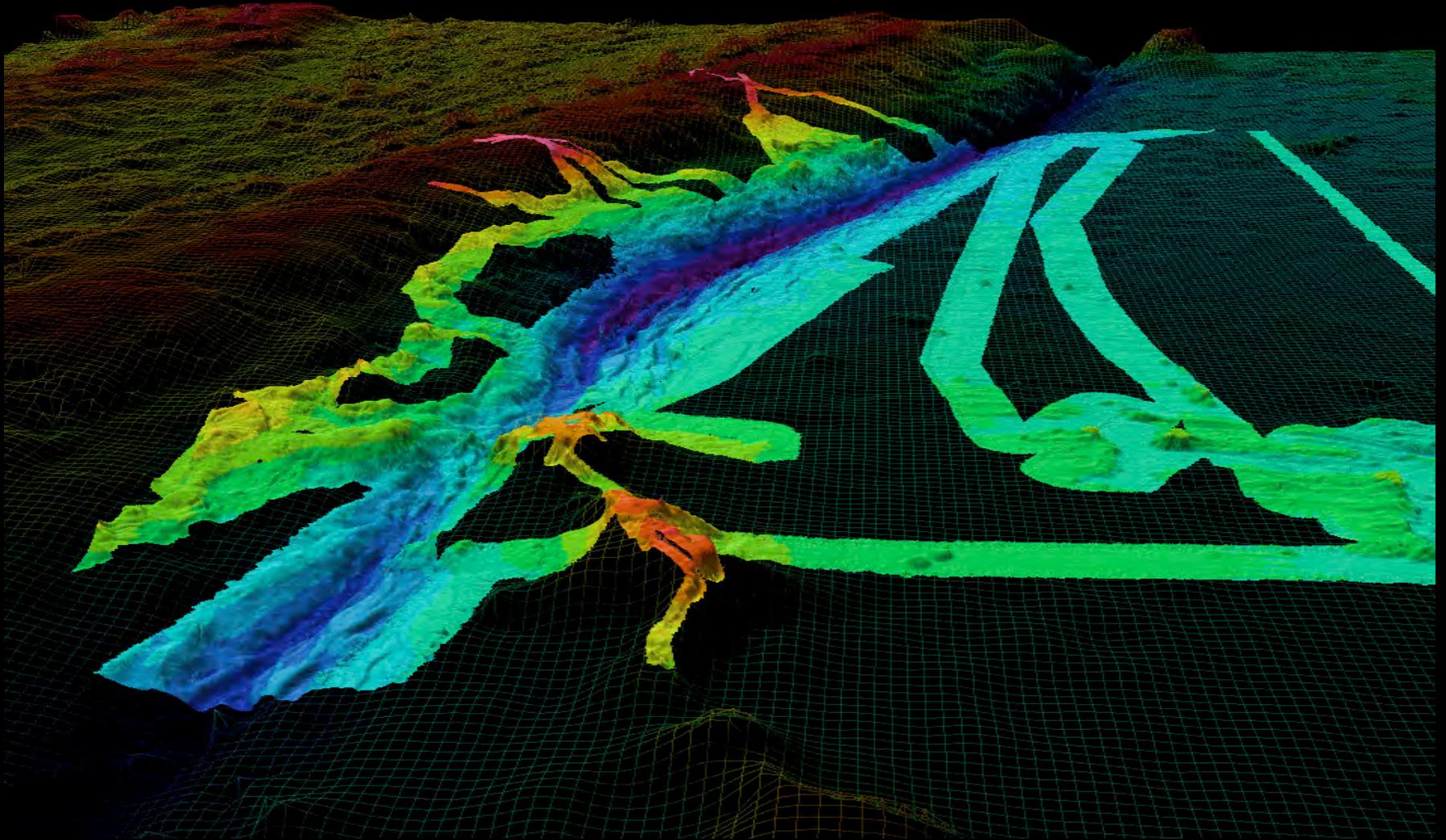


Image modified by Hart et al. (2004) from Ruellan et al. (2003)

September 29 Quake & Tsunami



Only 5-10% of global seafloor charted with ships
- “We need ~125 more years!...” *



*Sandwell et al. (2003), *Eos, Transactions AGU*; Image courtesy of Steve Miller, Scripps GDC

Primary Data Acquisition: “Deep”

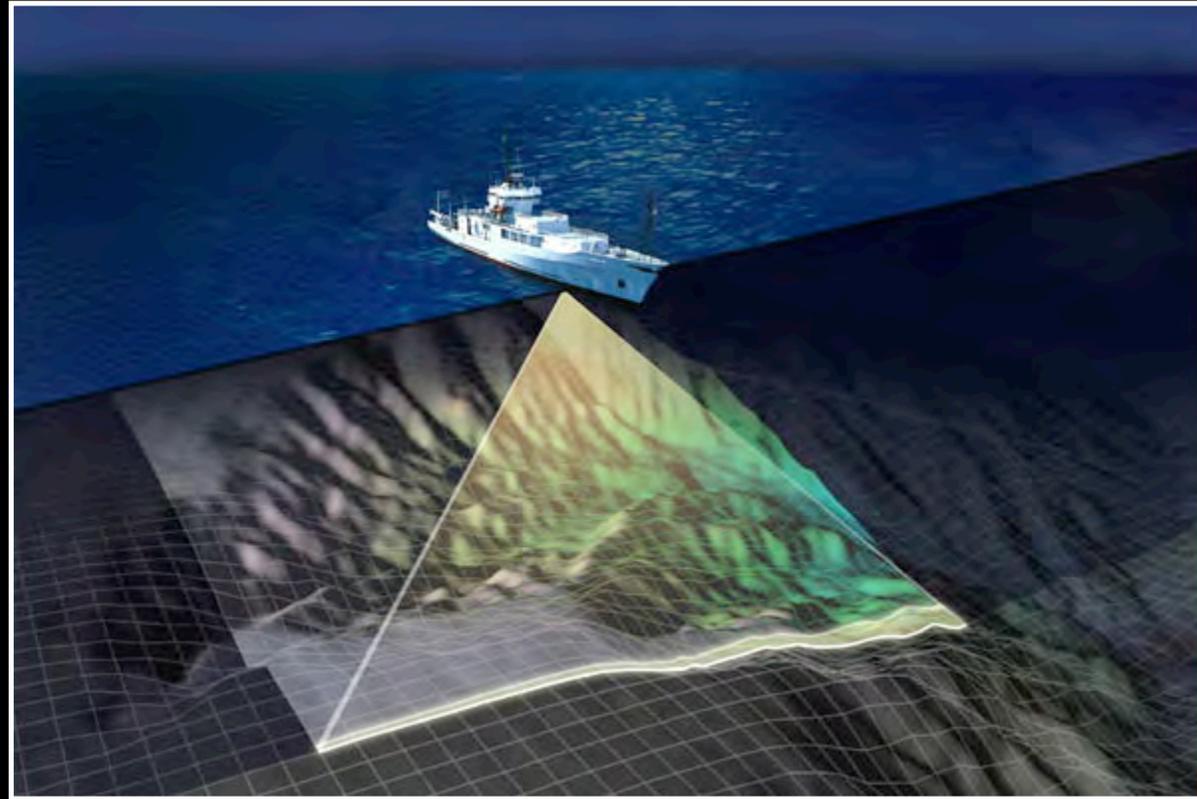


Image from Lost City Expedition (2003)

Multibeam sonar, regional scale,
200 m and deeper

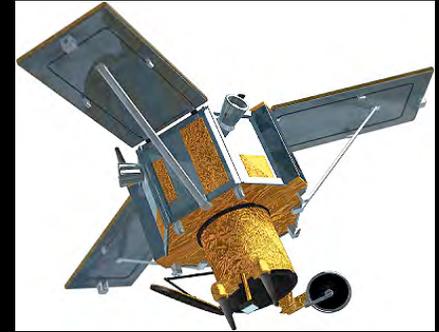
Primary Data Acquisition: "Shallow"



R/V *Acoustic Habitat Investigator*
w/ RESON 8101



Portable, pole-mounted EM3000



Ikonos satellite
(Image from SatMagazine)

Multibeam sonar, 200 m and shallower
Ikonos, shoreline to 15 m

Data Description

Multiple datasets collected during separate research cruises (1984-2006)

Surveys operated by numerous institutions with a variety of scientific objectives

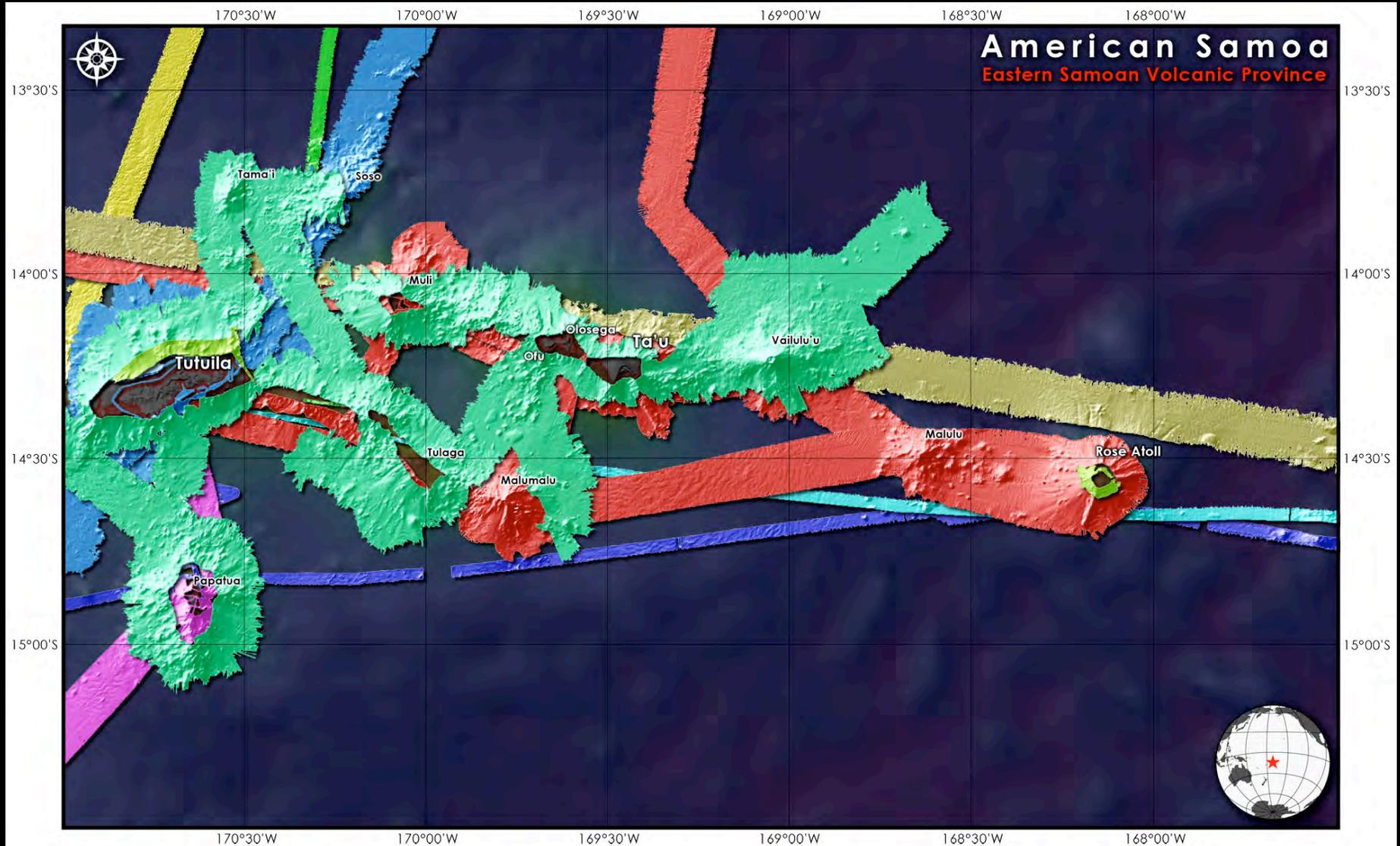
Data collected by various shipboard multibeam sonar systems with differing quality

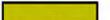
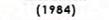
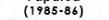
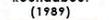
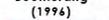
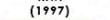
Regional data merged at a resolution of 200 m, covering an area of 28,446 km²

Deep Multibeam by Expedition

Expedition	Year	Institution(s)	Vessel
Marathon	1984	Scripps Institution of Oceanography	R/V <i>Thomas Washington</i>
Papatua	1985-86	Scripps Institution of Oceanography	R/V <i>Thomas Washington</i>
Roundabout	1989	Scripps Institution of Oceanography	R/V <i>Thomas Washington</i>
Boomerang	1996	Oregon State University, Scripps Institution of Oceanography	R/V <i>Melville</i>
Kiwi	1997	Scripps Institution of Oceanography	R/V <i>Revelle</i>
AVON	1999	Scripps Institution of Oceanography, Woods Hole Oceanographic Institution	R/V <i>Melville</i>
Cook	2001	University of Rhode Island	R/V <i>Melville</i>
Drift	2002	Scripps Institution of Oceanography, University of South Florida	R/V <i>Revelle</i>
ALIA	2005	Woods Hole Oceanographic Institution	R/V <i>Kilo Moana</i>
HURL	2005-06	Hawaii Undersea Research Lab	R/V <i>Ka'imikai-O-Kanaloa</i>

Multibeam Swaths by Expedition



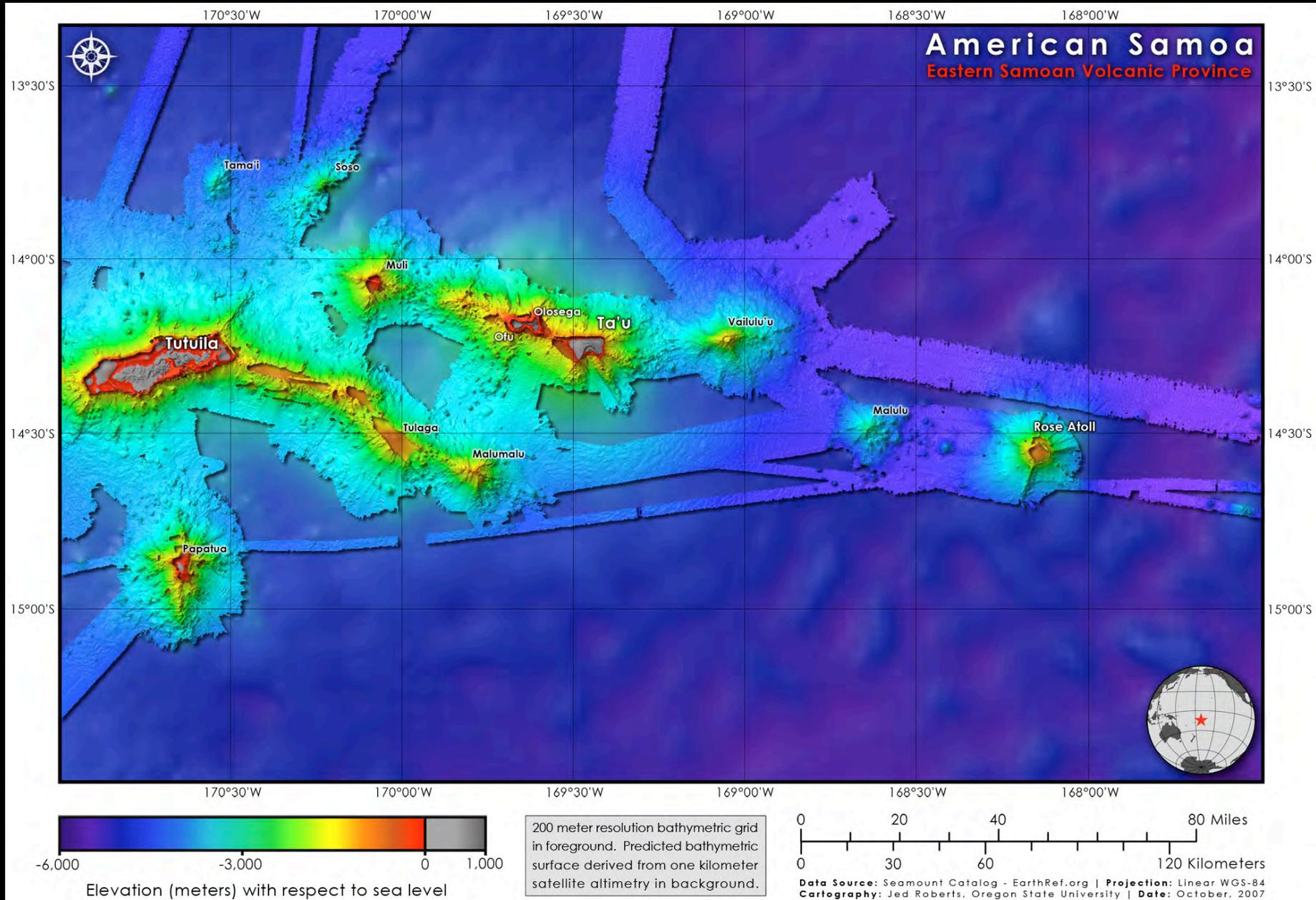
- | | | | | |
|--|--|--|---|---|
|  Marathon
(1984) |  Papatua
(1985-86) |  Roundabout
(1989) |  Boomerang
(1996) |  Kiwi
(1997) |
|  AVON
(1999) |  Cook
(2001) |  Drift
(2002) |  ALIA
(2005) |  HURL
(2005-06) |

Multibeam bathymetry by research expedition. Swaths layered chronologically. Shallow swaths by PIFSC and KM0505 not included. RNDB15WT overlapped completely. 180 meter resolution.

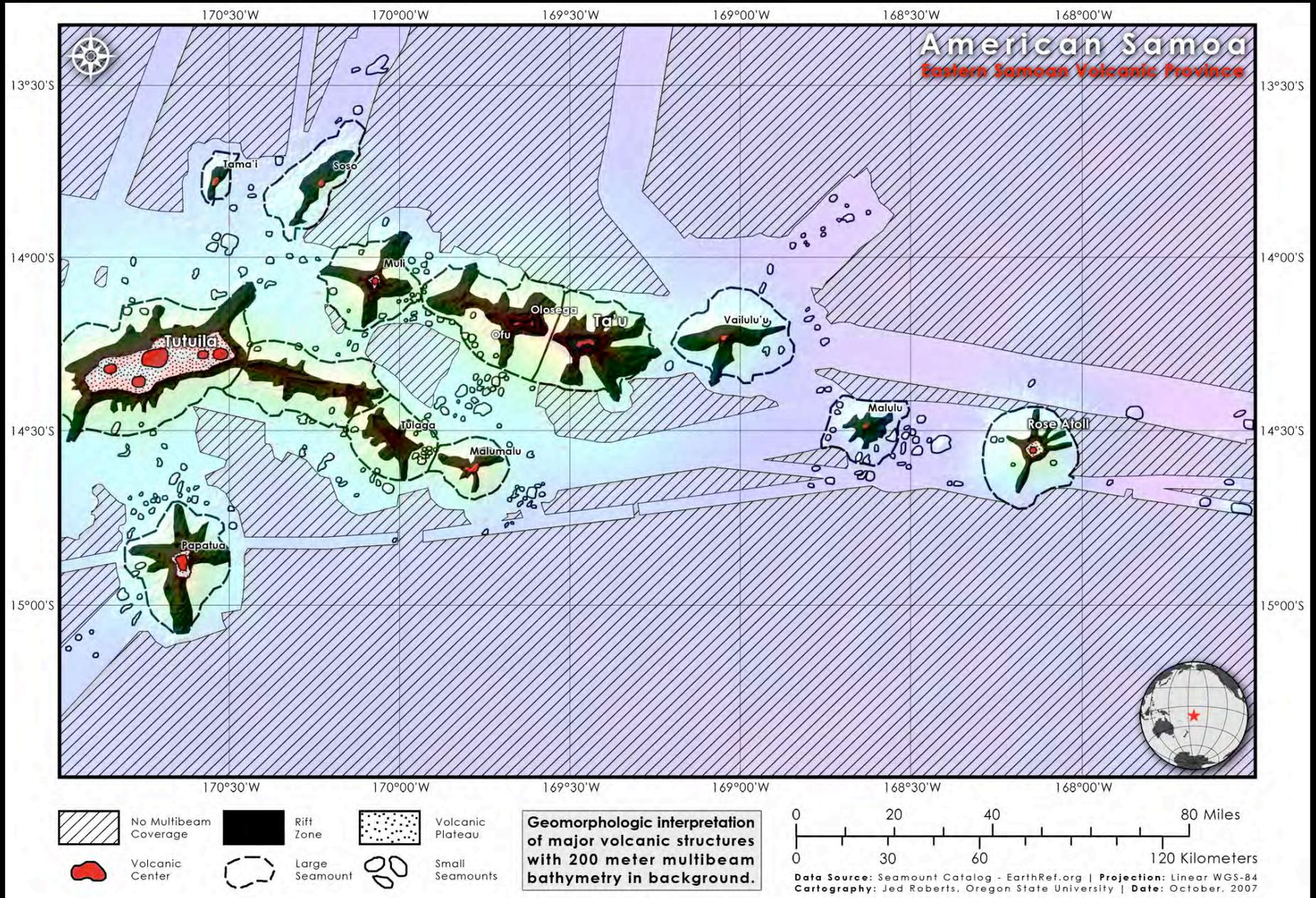
0 20 40 80 Miles
0 30 60 120 Kilometers

Data Source: Seamount Catalog - EarthRef.org | Projection: Linear WGS-84
Cartography: Jed Roberts, Oregon State University | Date: October, 2007

Deeper Multibeam Compilation



Interpretation of Major Features



Benthic Habitats of American Samoa

Products Derived for Tutuila and Aunu'u Islands from IKONOS Satellite Imagery

Benthic Habitat Mapping

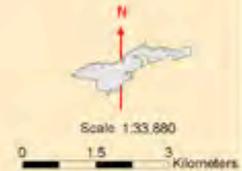
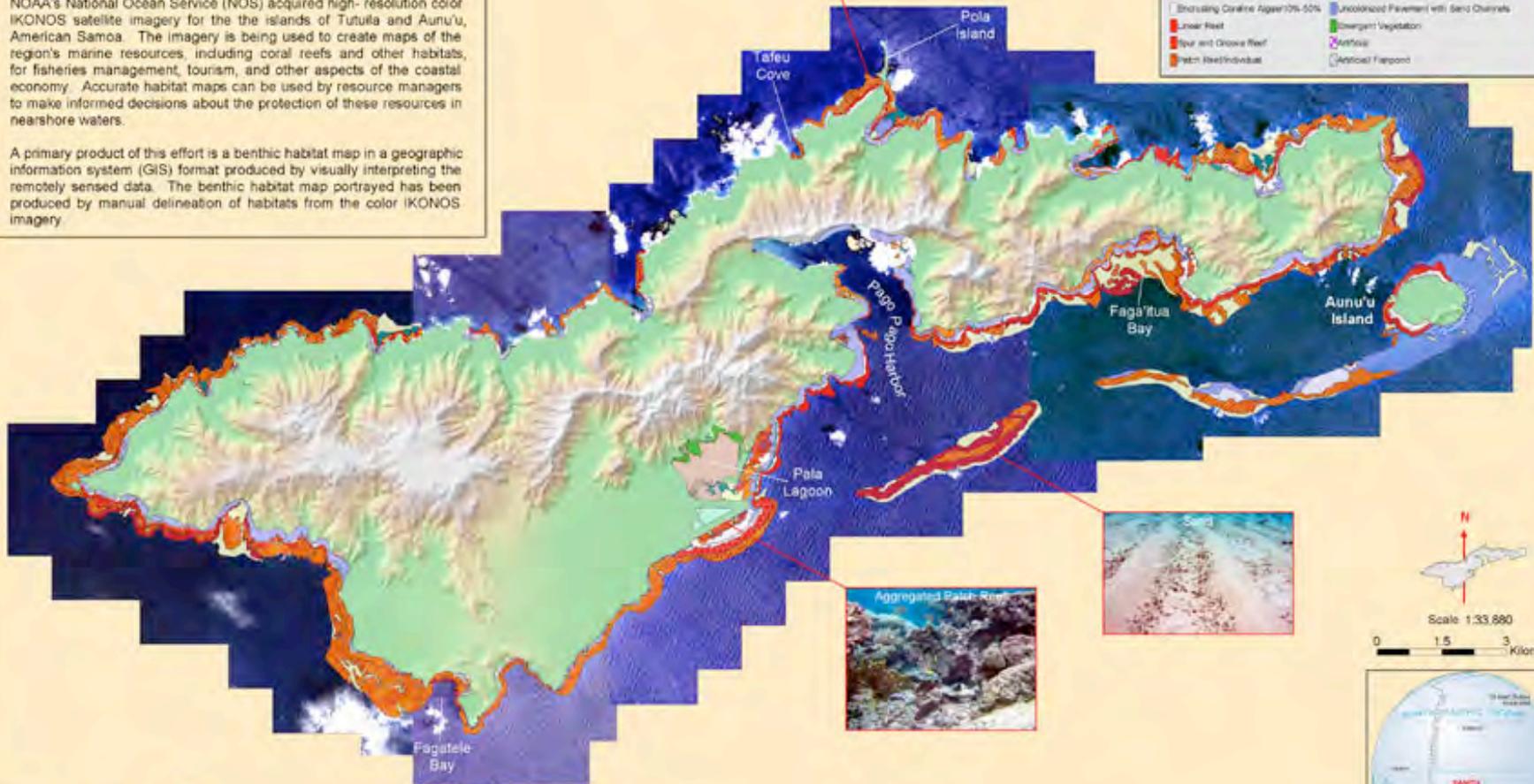
This draft benthic habitat map was developed by the American Samoa mapping team. The team includes staff from the American Samoa Government (Department of Marine and Wildlife Resources, Environmental Protection Agency, Department of Commerce), the National Oceanic and Atmospheric Administration's (NOAA) Fagatele Bay National Marine Sanctuary, the National Ocean Service, the Department of Interior's National Park of American Samoa, and Analytical Laboratories of Hawaii.

NOAA's National Ocean Service (NOS) acquired high-resolution color IKONOS satellite imagery for the islands of Tutuila and Aunu'u, American Samoa. The imagery is being used to create maps of the region's marine resources, including coral reefs and other habitats, for fisheries management, tourism, and other aspects of the coastal economy. Accurate habitat maps can be used by resource managers to make informed decisions about the protection of these resources in nearshore waters.

A primary product of this effort is a benthic habitat map in a geographic information system (GIS) format produced by visually interpreting the remotely sensed data. The benthic habitat map portrayed has been produced by manual delineation of habitats from the color IKONOS imagery.



Blank	Wet Reef Aggregated
Mud	Dark Hard/Individual
Seagrass 90%-100%	Dark Hard/Aggregated
Seagrass 50%-90%	Scattered Corals/In Unconsolidated Sediments
Seagrass 10%-50%	Colonized Pavement
Macroalgae 90%-100%	Colonized Volcanic Rock/Boulder
Macroalgae 50%-90%	Colonized Pavement with Sand Channels
Macroalgae 10%-50%	Unconsolidated Pavement
Surrounding Corals Algae 90%-100%	Reef Rubble
Surrounding Corals Algae 50%-90%	Unconsolidated Volcanic Rock/Individuals
Surrounding Corals Algae 10%-50%	Unconsolidated Pavement with Sand Channels
Linear Reef	Emergent Vegetation
Spur and Groove Reef	Artificial
Wet Reef Individual	Artificial Filling

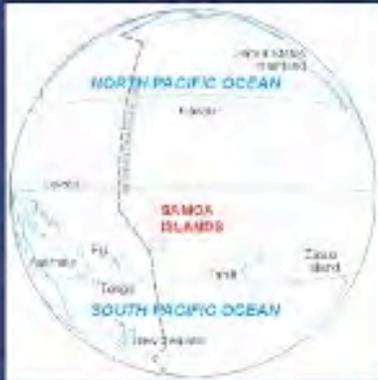


NOAA Center for Coastal Monitoring and Assessment
<http://biogeo.nos.noaa.gov>



American Samoa

Tutuila and Aunu'u



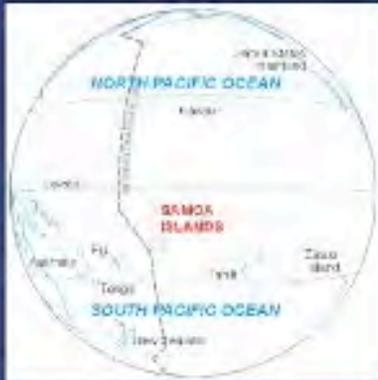
Courtesy: National Park Service



*Emily M. Larkin
Department of Geosciences
Oregon State University
June 1, 2003*

American Samoa

Tutuila and Aunu'u



Courtesy: National Park Service

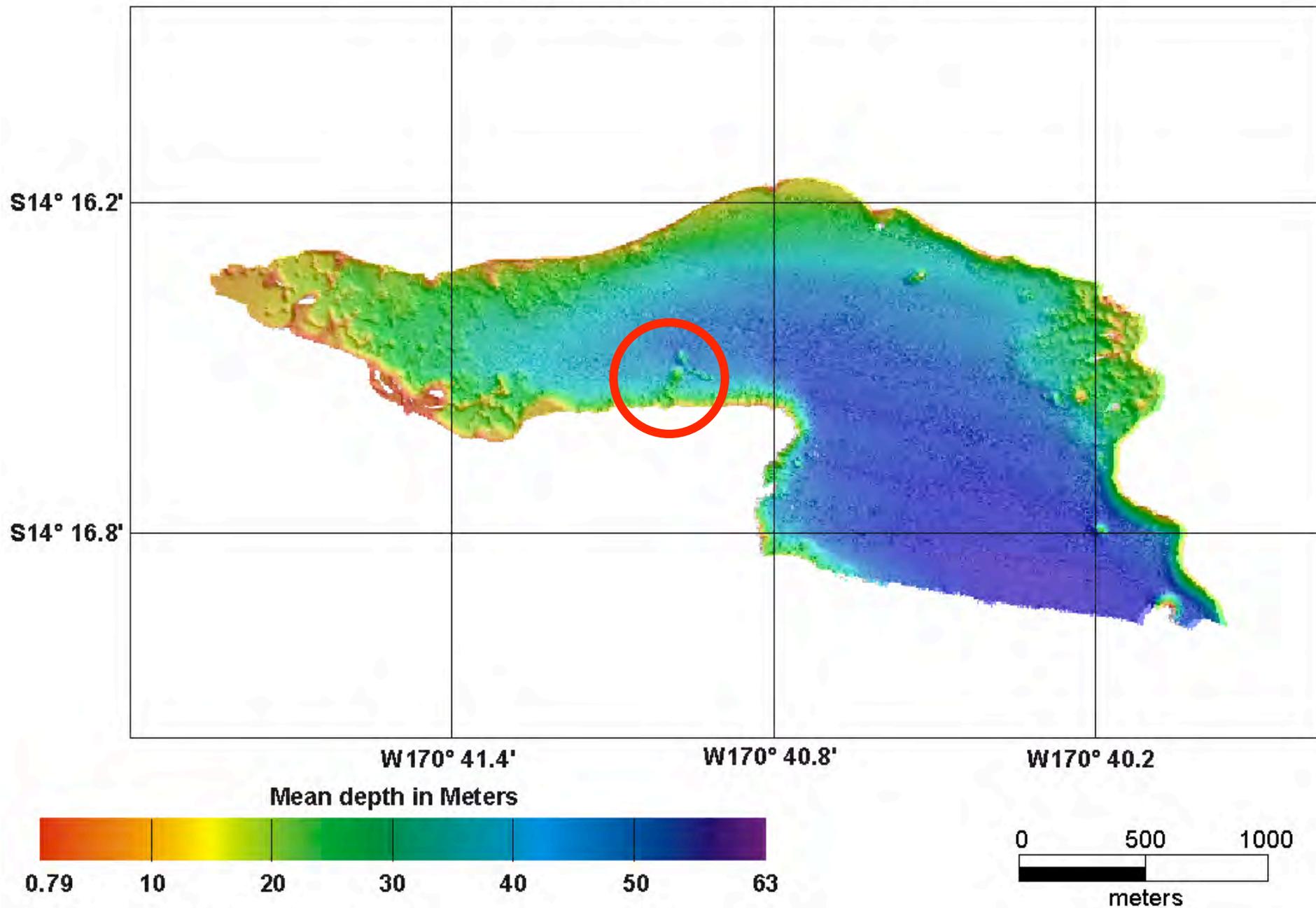


*Emily M. Larkin
Department of Geosciences
Oregon State University
June 1, 2003*

* NOT FOR NAVIGATION

Pago Pago Harbor, American Samoa

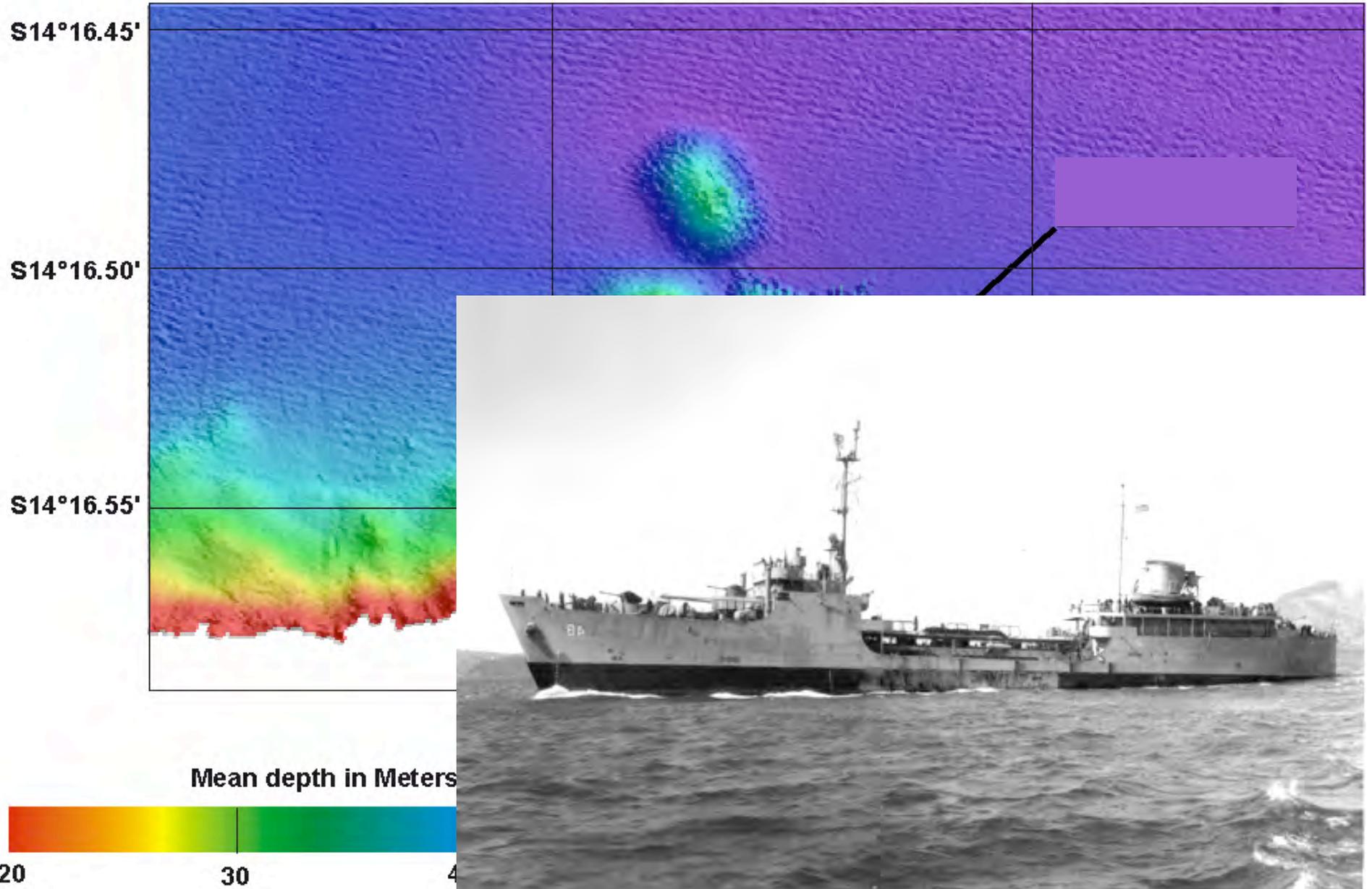
processed at 1 meter per pixel



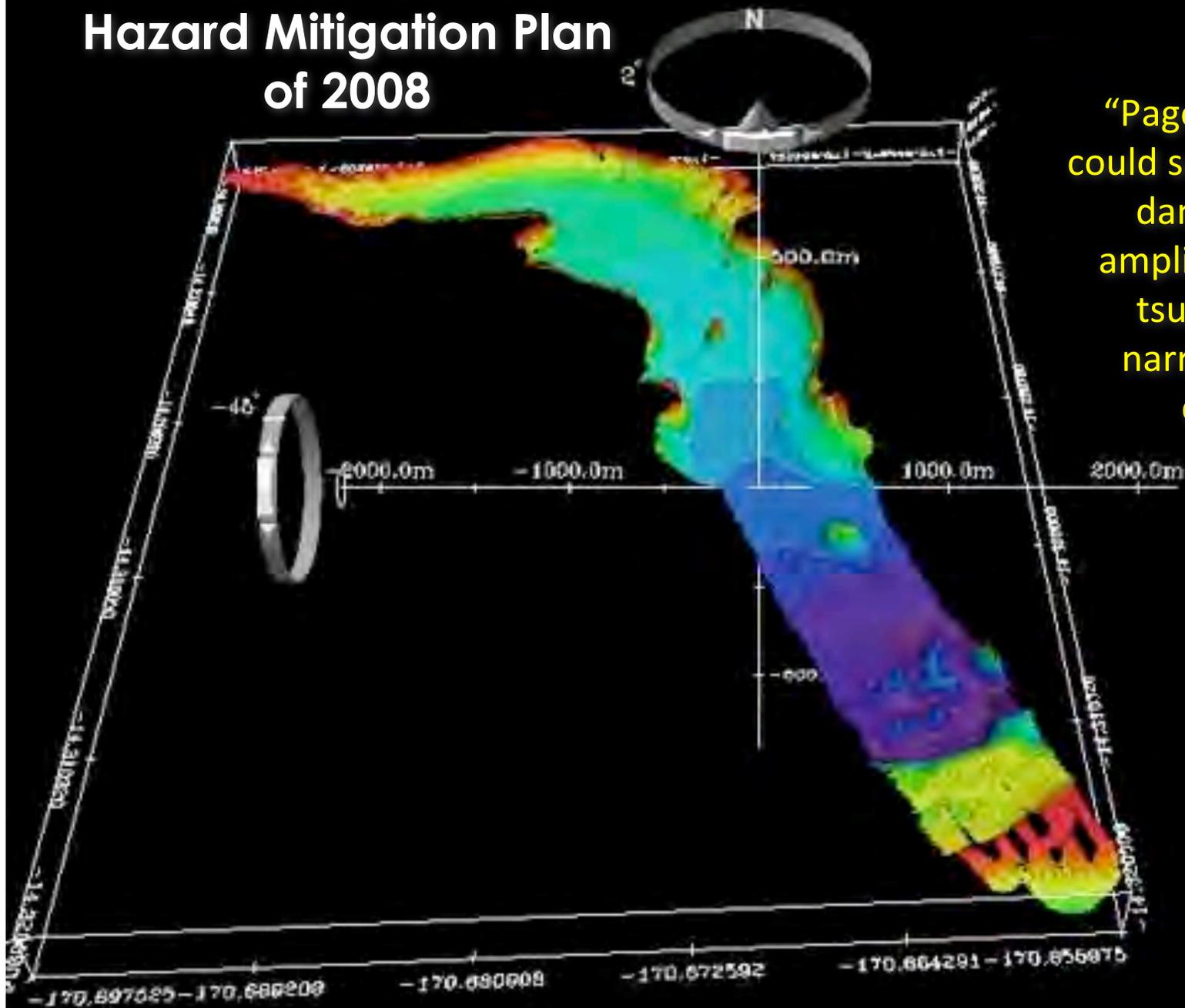
* NOT FOR NAVIGATION

Pago Pago Harbor, American Samoa

processed at 1 m per pixel



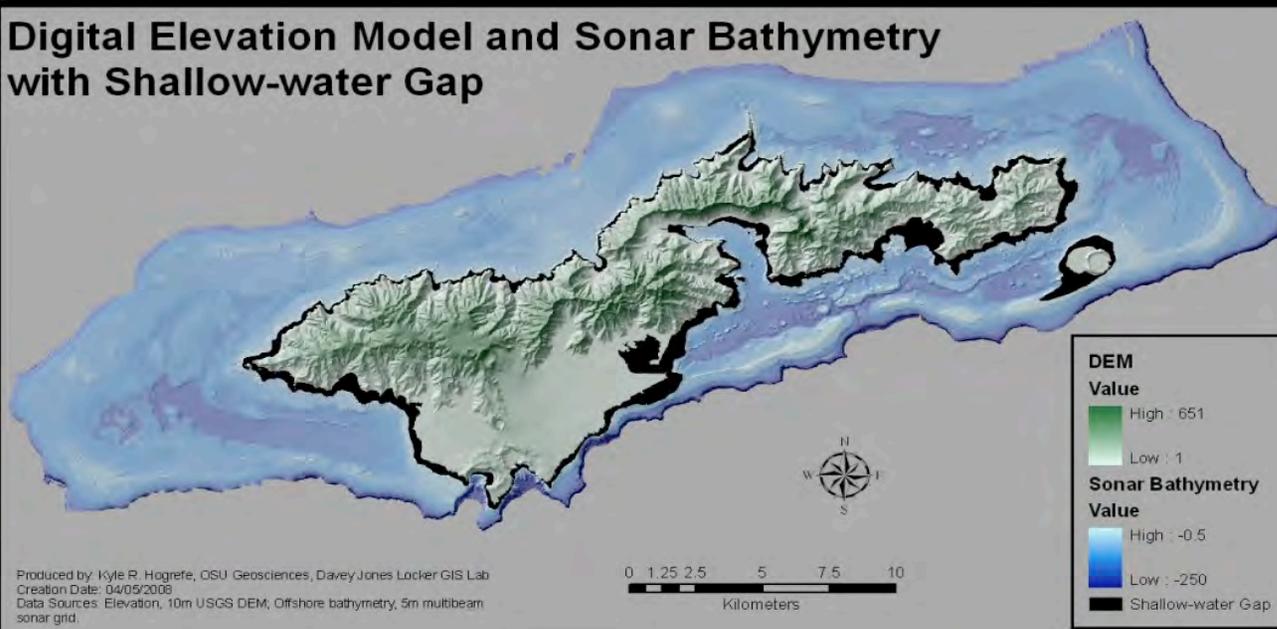
American Samoa Hazard Mitigation Plan of 2008



“Pago Pago Harbor could sustain the worst damage due to amplification of the tsunami by the narrowing of the channel.”

Shallow Bathy w/Tutuila Island

Digital Elevation Model and Sonar Bathymetry with Shallow-water Gap



Kyle Hogrefe
OSU M.S. Thesis



Lim, Eakins, & Taylor U21E-2188 Poster Tsunami Inundation DEM



Elliott Lim et al., NOAA NGDC

Community Engagement



Fagatele Bay National Marine Sanctuary

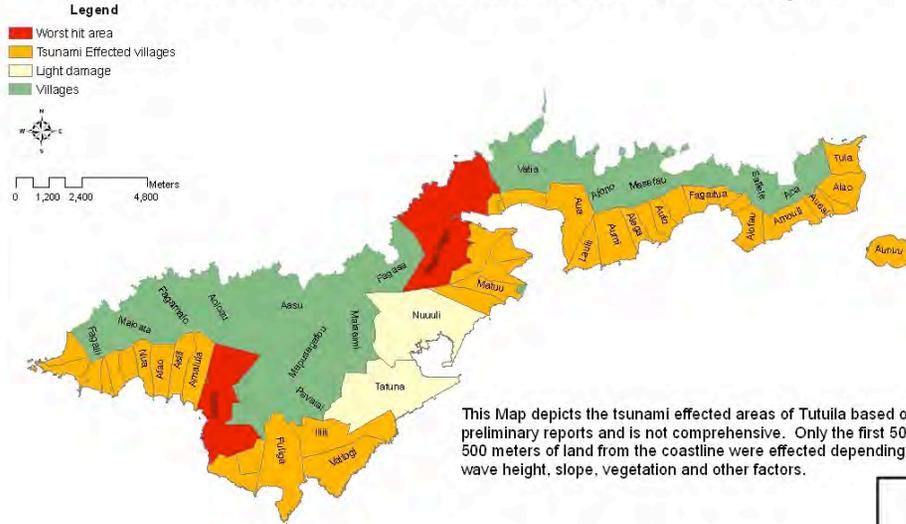


- Coastal Mgmt Program
- **AS GIS Users Group**
- Dept of Marine & Wildlife Resources
- Dept of Public Works
- AS Power Authority
- National Park of AS
- AS Environmental Protection Agency
- AS Community College
- AS Historic Preservation Office



Initial Tsunami Damage Maps

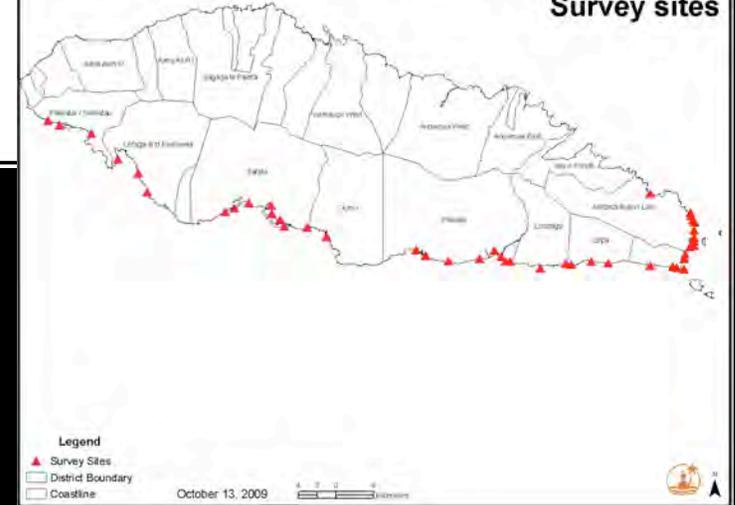
American Samoa Tsunami Effected Villages



This Map depicts the tsunami effected areas of Tutuila based on preliminary reports and is not comprehensive. Only the first 50 to 500 meters of land from the coastline were effected depending on wave height, slope, vegetation and other factors.

Paul Anderson
American Samoa Government

Samoa Tsunami Rapid Environmental Impact Survey Survey sites



This Map depicts the results of 2 surveys by car on the main road, only the first 50 to 500 meters of land from the coastline were effected depending on wave height, slope, vegetation and other factors. Where the road leaves the coastline tsunami impact is ASSUMED but not VERIFIED. Manono Uta, Apulima foa, Lalomanu, Poutasi, Alespata district, have all experienced major effects. Coconut, Sea breeze, Simale, and all the fales along Lalomanu have been partially or totally impacted. Impacts on Savali are unconfirmed.



Continuing Work Includes

Ongoing collaborations with American Samoa
Government agencies...

NOAA Coral Reef Ecosystem Division, NOAA
Biogeography, NGDC ...

Eastern Samoa Volcanic Province bathy
compilation and seamount statistics paper to
G-Cubed ...

HURL submersible dives proposed for 2011

Continued updates at
dusk.geo.orst.edu/djl/samoa
seafloormapping.net
earthref.org/SBN
(Seamount Biogeosciences Network)



Fagatele Bay National Marine Sanctuary (FBNMS) GIS Data Archive

Last update: July 3, 2003

Where is American Samoa?

About FBNMS

FBNMS Main Site

AS GIS User Group

Photo Gallery

Deep Diving Mission

GIS Tools

This site provides GIS data from recent shallow-water multibeam bathymetric surveys conducted in 2001 and 2002 in support of the Fagatele Bay National Marine Sanctuary, **American Samoa** in the SW Pacific Ocean. Most high-resolution multibeam bathymetric data were collected with a Kongsberg Simrad EM3000 system owned and operated by the Center for Coastal Ocean Mapping, Department of Marine Science, U. of South Florida. Also included is a recent compilation of terrestrial GIS data layers obtained from the American Samoa GIS User Group various photographic images and interchange files (i.e., *.e00 files), free GIS data viewer ArcExplorer, **undergone corrections for diffe**

GIS Data Layers

BATHYMETRIC GRIDS

DATA SET	THUMBNAIL GRAPHIC	FGDC METADATA	DOWNLOAD FILE
Fagaitua Bay Bathymetry, 1-m grid	fagai.gif	fagaitua1m.htm	fagaitua1m.zip (842 K) fagaitua1m.e00.Z (1.4 Mb)
FBNMS Bathymetry, 1-m grid	fb_sml.gif	fbnms1m_new.htm	fbnms1m_new.zip (957 K) fbnms1m_new.e00.Z (1.1 Mb)
FBNMS Bathymetry, 2-m grid	natpark.gif	natpark2m.htm	natpark2m.zip (1.3 Mb) natpark2m.e00.Z (1.3 Mb)

Benthic Terrain Modeler

Benthic Terrain Modeler

Welcome to the Benthic Terrain Classification Wizard.

This wizard allows users to classify benthic zones and associated structures from bathymetric data sets in ESRI's Grid raster data format. As you move through the benthic terrain classification process, click on the More about... buttons to launch the interactive help window and obtain more information on the methods utilized by the Benthic Terrain Modeler.

Click on the Next -> button to begin.

Benthic Zones and Associated Structures in Fagatele Bay NMS, American Samoa

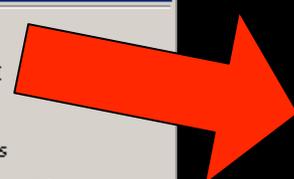
0 0.1 0.2 0.3 0.4 Miles

More about the Benthic Terrain Classification Wizard...

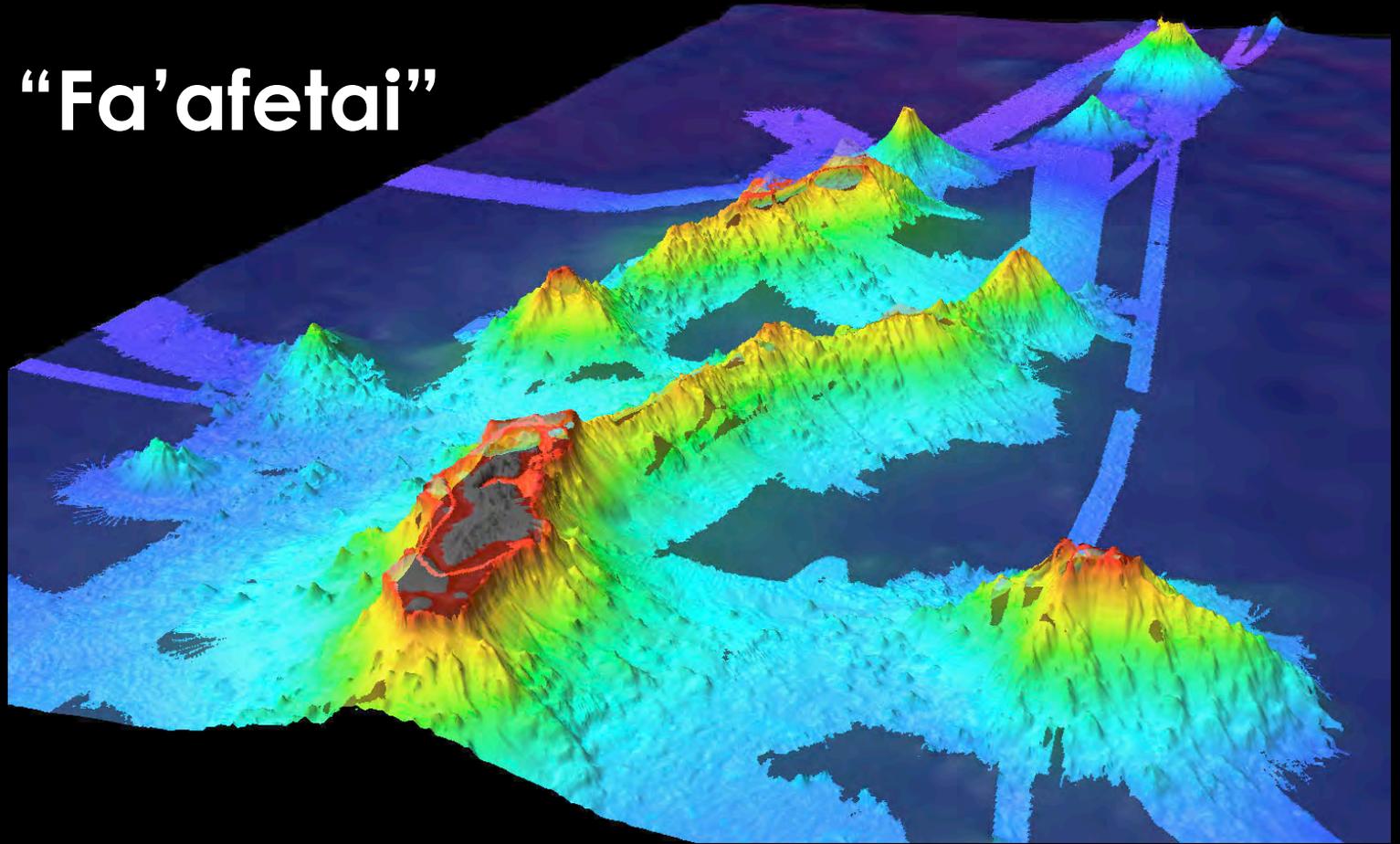
Next -> Cancel

Benthic Terrain Modeler Menu

- Benthic Terrain Classification Wizard
- Resample
- Build Broad Scale BPI
- Build Fine Scale BPI
- Standardize BPI Grids
- Classification Dictionary Editor
- Terrain Classification Builder
- Rugosity Builder
- Help



“Fa’afetai”



Download:

http://dusk.geo.orst.edu/agu09_samoa.html

More info:

dawn@dusk.geo.orst.edu